January 26, 2009

VIA MESSENGER AND ELECTRONIC MAIL

Dr. Richard Wright
Chairman, San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA. 92123-4340

Re: February 11, 2009 San Diego Regional Board Meeting, Item 6 - Poseidon Resources Corporation, Proposed Carlsbad Desalination Project (Order No. R9-2006-0065, NPDES No. CA0109223

Dear Chairman Wright:

At the request of Poseidon Resources Corporation, I have prepared the enclosed statement to assist the agency's consideration of Poseidon's Marine Life Mitigation Plan, which I understand is agendized for the agency's February 11 meeting.

If you have any questions, please feel free to contact me.

Respectfully submitted,

Dr. David Mayer, Ph.D.
President / Principal Scientists
Tenera Environmental

Enclosure
Expert Opinion

2009 JAN 26 P 4:50
REGIONAL
QUALITY
BOARD

Email and memorialized telephonic correspondence between Tenera and Dr. Raimondi

From: John Steinbeck [jsteinbeck@tenera.com]
Sent: Tuesday, April 22, 2008 11:07 AM
To: Pete Raimondi
Cc: Dave Mayer
Subject: Variance Calculations

Hi Pete,
The ETM variances in the Encina study were calculated using the weighted (same survey weights used in ETM calcs) average CV from the PE estimates which integrates the entrainment and source water variances. The source water variances for the nearshore and lagoon were calculated separately and then added into the total for the final variance calculation.

John

><+-> * <++>< ><+-> * <-+><
John Steinbeck
Tenera Environmental
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San Luis Obispo, CA 93401
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><+-> * <++>< ><+-> * <-+><

From: John Steinbeck [jsteinbeck@tenera.com]
Sent: Thursday, April 24, 2008 6:05 PM
To: Dave Mayer
Subject: ETM Numbers

Dave - Numbers given to Pete over the phone...
Grid length = 6.3 km
PS Values
CA halibut - 0.17
Spotfin Croaker - 0.34
Queenfish - 0.23
Anchovy - 0.30
White Croaker - 0.14

><+-> * <++>< ><+-> * <-+><
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APF Calculations for Carlsbad Desalination Project

January 23, 2009

Prepared for:
Poseidon Resources inc.

Prepared by:
Tenera Environmental
David Mayer, PhD
971 Dewing Ave., Suite 101
Lafayette, CA 94549
925 283-9989

I. INTRODUCTION

My comments on the presentation that Dr. Raimondi gave to the CA Coastal Commission (CCC) on the mitigation for the Carlsbad Desalination Project are provided below and presented by slide number. The comments focus on his calculations, which encompass slides 7–20.

II. SUMMARY OF INFORMATION RELIED UPON

The Coastal Commission engaged Dr. Raimondi, a professor at UC Santa Cruz, to conduct an independent third-party peer-review of Poseidon's entrainment and source water study of the proposed Carlsbad Desalination Project's (CDP's) intake effects and mitigation restoration plan. Dr. Raimondi presented his findings in a joint meeting on April 25, 2008 between the Coastal Commission staff, Poseidon and both parties' consultants. The set of slides that Dr. Raimondi used to present his constitutes the extent of his reported methods, analytical results and findings. To the best of my knowledge, the documents that Dr. Raimondi relied upon in his review included:

1. Cabrillo Power I LLC Encina Power Station CLEANWATER ACT SECTION 316(b) IMPINGEMENTMORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment, January 2008, as submitted in the same date to the San Diego Regional Water Quality Control Board, as prepared by 141 Suburban Rd. Suite A2 San Luis Obispo, CA 93401 and 971 Dewing Ave. Suite 101 Lafayette, CA 94549

2. Email From John Steinbeck jsteinbeck@tenera.com Thursday, April 24, 2008 5:04 PM To Dave Mayer dmayer@tenera.com that read:

Dave - Numbers given to Dr. Raimondi over the phone...
Grid length = 6.3 km
PS Values
CA halibut - 0.17
Spotfin Croaker - 0.34
Queenfish - 0.23
Anchovy - 0.30
White Croaker - 0.14

John Steinbeck

3. Email From John Steinbeck jsteinbeck@tenera.com Tuesday, April 22, 2008 10:07 AM To: Dr. Raimondi Raimondi <raimondi@biology.ucsc.edu> CC: Dave Mayer <dmayer@tenera.com> that read:

Hi Dr. Raimondi,
The ETM variances in the Encina study were calculated using the weighted (same survey weights used in ETM calcs) average CV from the PE estimates which integrates the entrainment and source water variances. The source water variances for the nearshore and lagoon were calculated separately and then added into the total for the final variance calculation.
John

I assume that the CCC also made available to Dr. Raimondi some number of other documents on the subject of Poseidon's entrainment studies and proposed restoration mitigation plan, which had been submitted by Poseidon in the course of permitting and licensing their desalination facility. I assume this to be the case based on Dr. Raimondi's comment in his presentation, Slide # 2 General Comments, which reads:

1) As written, the report could not be evaluated for the technical merits of the entrainment study or estimation of APF a) Tenera provided both a meeting to discuss the report and also provided the material needed to assess the entrainment study and APF calculations.

2) My assessment is based in part on calculations I did using material from the CDP report, the 316B report from Encina Power plant and from direct communication with Tenera

III. COMMENTS ON SLIDES

A. Slide# 2 – General Comments

In comment #2, Dr. Raimondi is referring to Poseidon's interim entrainment study report, which could not be completed without the consent of the Cabrillo Power I LLC Encina Power Station, inasmuch as Cabrillo Power I LLC Encina Power Station had jointly participated with Poseidon in the conduct of the entrainment and source water studies. The complete findings of the two-party study were published in the

above referenced January 2008 report, referred to by Dr. Raimondi as the 316B report from Encina Power plant.

Although the cooperative, joint entrainment-and-source water study was both cost-effective and best for the environment, the reporting of study findings apparently lead to some confusion among various agencies, as evidenced in comments by the SD RWQCB and others. The Encina Power Station ("EPS") hired Tenera Environmental ("Tenera") to conduct an entrainment and impingement study. Tenera prepared a study plan, which EPS then to the San Diego Regional Water Quality Control Board ("Regional Board"), US Fish & Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, and other resource and regulatory agencies.

The Regional Board sent the study under an EPA Basic Ordering Agreement (BOA) to Tetra Tech, the Agency's contractor for third-party independent review of entrainment and impingement study plans. Tetra Tech reviewed the study plan and returned it with comments, which were addressed, and then approved by the Regional Board for implementation. Dr. Raimondi found that Tenera's study plan was "consistent with recent entrainment studies conducted under 316B rules" (Slide #3).

B. Slide# 3 – General Comments *(cont.)*

Dr. Raimondi concluded that Tenera's calculations of Proportional Mortality (Pm), Source Water Body (SWB) and Area of Production Foregone (APF) were "generally consistent with recent studies." (Slide #3, Comment 4). He also found that the study plan, field program (i.e. data collection effort), and the analysis of entrainment effects were consistent with contemporary science and methodology, and wholly acceptable for analysis of mitigation.

Dr. Raimondi has participated in the design and critical review of data collection and analysis for entrainment and impingement studies at many of California's seawater intakes, and is considered by many to be California's leading independent scientist on the subject. Dr. Raimondi's statistical and analytical knowledge have significantly advanced the science and methodology of entrainment impact assessment and mitigation.

In this case, Dr. Raimondi noted that Poseidon's original proposal did not account for entrainment-related impacts on open ocean species. He explained that "[n]o mitigation was proposed for losses of larvae from open water habitats." <u>As an expert in the area of entrainment assessment and mitigation, however, I had never heard of an instance when an entrainment study for an estuarine intake called for mitigation of open ocean marine life</u>.

Nevertheless, Dr. Raimondi decided to factor open water ocean species into the entrainment model. Dr. Raimondi applied a calculation method by which he determined with an 80 percent

confidence level that 5.5 acres of mitigation acreage would compensate for any impact the Desalination Plant, operating in stand-alone mode, might have on the open ocean. As acknowledged by Dr. Raimondi, the Acres of Production Forgone for the open ocean "is small, but non-zero."

C. Slide 7 – Calculated Pm, Standard Error (SE) and Source Water Body (SWB) Estimates

In Slide # 7, Dr. Raimondi relies upon the values of ETM (Tenera's Emprirical Transport Model) and SE (standard error) for estuarine and open water species presented in the Poseidon and Cabrillo entrainment reports to calculate a fraction, SE/ETM, expressing the amount of variance, SE, of the ETM values to the average ETM value. Dr. Raimondi also includes the acres of estuarine habitat as reported by Poseidon and the linear area of open ocean habitat that he calculated using the PS values sent to him in Tenera's email #2 shown above.

The source water area of 302 acres for the estuarine fish species represents the area at mean sea level of all three segments of Agua Hedionda Lagoon (AHL). This assumes that these three fishes utilize the entire area of AHL as adult spawning habitat. In fact, the actual source water habitats for each of the fishes are different and areas considerably less than the value of 302 acres. The assumption that the source water areas are equal is necessary for his calculations of an average PM for the estuarine species. As presented, this assumption is conservative and tends to increase the calculated APF to values above what may be necessary for mitigation.

D. Slide 9 – Use of Area of Production Foregone (APF) to Estimate Mitigation Required To Mitigate Entrainment Losses

In Slide # 9, Dr. Raimondi presents an example calculation to illustrate how the estimated entrainment impact value, PM (proportional mortality) that expresses the number of entrained larvae to the number of larvae in the source water is multiplied by the size or volume of the source water assumed to have produced the larvae. Knowing the relationship between the acres of source water habitat or volume and the number of larvae in source water, then by reason the number of larvae entrained represent the larval production from the acres or volume of water required to produce the larvae. On this basis, it can be further reasoned that creating, restoring or preserving an amount of source water habitat equivalent to the PM of entrainment represents a true offset of the entrainment losses and habitat services above and beyond the entrained loss. In his example, Dr. Raimondi illustrates the process by multiplying the source water body (acres) by the PM to find the acres of APF that would mitigate the entrainment loss. However, he concludes his comment with the thought that there is uncertainty in the estimate of PM ("The major issue is the error rate associated with estimation of Pm") that would result in a degree of uncertainty into the product of PM and SWB. Dr. Raimondi goes on to investigate this uncertainty in the form of entrainment and source water samples, the potential effect of

uncertainty on Poseidon's estimate of 100 percent mitigation acres, and concludes that, based on his evaluation of the variance of PM, Poseidon should add more mitigation acres to its original estimate or 37 acres.

The math here is very straightforward and correct. The estimate of APF is the product of the proportion of the population lost due to entrainment (P_M) and the area of adult habitat used by reproductively mature fish for spawning. The APF represents the area of adult habitat necessary to produce the larvae lost due to entrainment. Although, the slide states that the "major issue is the error rate associated with the estimation of P_M", there is also error associated with the estimate of the SWB, especially when the SWB area is overstated, as noted above in the comments on Slide 7.

E. Slide 10 – Understanding Uncertainty Of Compensation Through Mitigation Using APF (Direct Impacts Only)

The calculations on this slide are derived directly from standard statistical theory. The graph shown in the slide is the cumulative probability function for a set of normally distributed data with a mean of 50 and a given standard error. The curve in the slide shows the probability on the y-axis that a value less than or equal to the corresponding APF value on the x-axis would occur from a sample of normally distributed data with the given mean and standard error. Translated into confidence intervals, the distribution represents the corresponding values that would define the upper and lower limits for a confidence interval based on a given probability level. For example, a 90% confidence interval (5% to 95% on curve) would range from ~10 to 90 acres. Placed into the context of a confidence interval centered on the mean, it is easy to see why the 50% probability level is always the average value since, on average, 50% of the values would be less than or equal to that value. Therefore the y-axis has nothing to do with compensation, it is the probability that the value from a sample of data with the specified mean and standard error is actually 50.

F. Slides 11-15

These slides present the various sources of error that could be used in the calculations. Dr. Raimondi uses the standard error in his calculations which he correctly states leads to more conservative (lower) estimates. This is also probably the correct estimate of error to use since the concept here is directly tied to confidence intervals, which are calculated using the standard error. He applies a commonly employed Z-statistic of probability distribution:

- Prob = ZCF ((acres – mean acres)/calculated SE)
- Where ZCF is the normal cumulative function

In order to produce the cumulative probability curves used in slides #14 and #15 to calculate the relationship between variance of PM and the number of mitigation acres required for compensation probabilities illustrated in slides 14, 15 and 17, Cases 1, 2 and 3, respectively. The

ZCF function is also used to calculate the number of acres required to achieve an 80% probability of compensation.

Dr. Raimondi's comment on Slide #13, "these are huge" is in reference to the high degree of variance (SE) to the estimated entrainment effect (PM). Although the ratios are large, they are not unexpected or atypical for wild populations, such as those reflected in the data set. Such populations frequently exhibit large variation with respect to abundance data, the underlying source of variation in this case. I do not believe Dr. Raimondi is criticizing the underlying data set, which he found provided a proper foundation for his entrainment evaluation.

In standard probability terms, when the ratio exceeds 100 percent (or 1.00 in Dr. Raimondi's table), it can only be said that the species are present or absent. However, in most quantitative studies of wild populations, the degree of sample replication required to achieve low CV's is prohibitive, and decision-making, based on such data, normally includes robust performance and outcome monitoring combined with adaptive management planning.

G. Slide 16 – Calculated P_M, Standard Errors (SE) and Source Water Body (SWB) Estimates

Dr. Raimondi has focused on using the APF's from the estuarine species to calculate the statistics used in his calculations. The only way to calculate an average APF is to assume that the SWB estimate is the same for all three species. We know that all three fishes occur in AHL, but the habitats they each occupy are very different. The individual APF values based on more accurate estimates of their actual SWB would be much smaller, but could not be averaged since they represent different habitats. The approach of using the entire area of AHL results in an overestimate of APF, which should account for any of the uncertainty associated with the estimate. For that reason, I do not believe it is necessary to calculate an upper bound on the estimate as Dr. Raimondi has done in Slide 17.

H. Slide 17 – Uncertainty Of Compensation Through Mitigation Using APF Estuarine Species Case 3: Using Error Rate Calculated From Species P_M Estimates

Same approach used on Slide 10 now using the calculated average APF and the standard error of that average estimate. Again, from Slide 10, the correct interpretation is that 80% of the values would be less than or equal to 49 acres. The value of an 80% confidence interval (interval including 80% of the curve) would be ~55 acres.

I. Slides 18 and 19

Same approach used on open coast fishes.

Review of Carlsbad Seawater Desalinization Project (CDP)

- General comments on report
- Assessment of calculations of Pm
  - Estuarine species
  - Open water species
- Assessment of mitigation alternative using APF calculations
  - Math
  - Habitats

General Comments

1) As written, the report could not be evaluated for the technical merits of the entrainment study or estimation of APF
   a) Tenera provided both a meeting to discuss the report and also provided the material needed to assess the entrainment study and APF calculations.
2) My assessment is based in part on calculations I did using material from the CDP report, the 316B report from Encina Power plant and from direct communication with Tenera
   a) Such calculations include: uncertainty analysis and APF for open coast species
3) The study design for entrainment sampling including source water sampling is consistent with recent entrainment studies conducted under 316B rules

General Comments

4) Calculations of Pm, SWB and APF are generally consistent with recent studies
   a) Note additional calculations shown in this presentation for uncertainty and open water species
5) Proposed mitigation at San Dieguito is the most likely alternative to lead to compensation for losses of estuarine larvae due to entrainment – if habitat created more closely mimics source water body
6) No mitigation was proposed for losses of larvae from open water habitats
   a) APF is small but non-zero
   b) Mitigation options with direct nexus to impact are difficult

Review of Carlsbad Seawater Desalinization Project (CDP)

- Assessment of calculations of Pm
  - Estuarine species
  - Open water species

Assessment of calculations of Pm

- Proportional mortality (Pm) estimates are calculated using standard methodology
- Source water estimation is complicated for estuarine species (but in my opinion – correct)
- Source water estimation is standard for open water species
- Estimation of error rates is mathematically correct but, in my opinion, not appropriate for use in APF calculations
  - More about this later
- Uncertainty of estimates, particularly as they affect APF calculations is not adequately discussed
  - More about this later

Understanding Proportional Mortality (Pm)

- Pm is the proportion of larvae at risk that are estimated to die as a result of entrainment
- Larvae at risk is determined by source water body (SWB) which differs for estuarine vs open water species
  - For estuarine species, it is generally the area of Agua Hediondo Lagoon that could produce larvae entrained
  - For open water species, it is the area from which larvae could have traveled from and then be entrained
    - Based on age of larvae entrained

Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

Species	Pm	Calcuated SE	Ratio SE/ Pm	Source water body *	Units
Estuarine					
Blennies	0.08635	0.1347	1.56	302	Acres
Gobies	0.21599	0.3084	1.43	302	Acres
Garibaldi	0.06484	0.1397	2.15	302	Acres
Open Water					
White Croaker	0.00138	0.0028	2.04	45	Km along shore
Northern Anchovy	0.00165	0.0026	1.56	21	Km along shore
California Halibut	0.00151	0.0024	1.58	37	Km along shore
Queenfish	0.00365	0.0049	1.33	27	Km along shore
Spotfin Croaker	0.00634	0.0153	2.41	19	Km along shore

*The source water body for estuarine species is actually different from this value, however it is assumed that larval production is primarily from 302 acres in Agua Hediondo Lagoon

Review of Carlsbad Seawater Desalinization Project (CDP)

- Assessment of mitigation alternative using APF calculations
  - Math
  - Habitats

Use of Area of Production Foregone (APF) to estimate mitigation required to mitigate entrainment losses

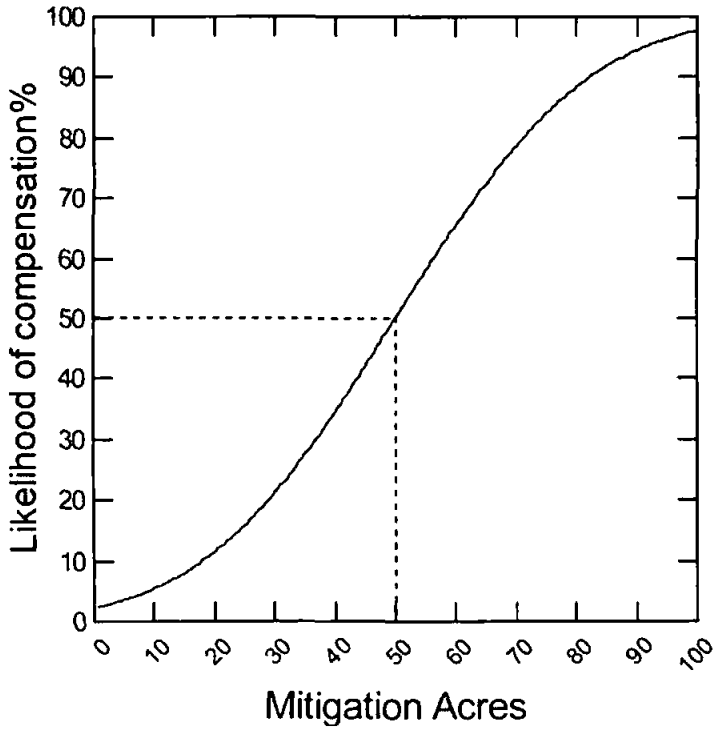
- Goal is to determine area required to provide sufficient habitat to produce larvae lost to entrainment
  - This area is the product of Pm and SWB
  - For example if the source water body (SWB) = 500 acres and Pm is 0.1 then the APF is

500 acres x 0.1 = 50 acres

  - This means that 50 new acres ***having a similar habitat mix as that in the SWB*** would produce larvae sufficient to make up for those lost to entrainment
  - This assumes no uncertainty in the estimation of Pm and SWB
    - The major issue is the error rate associated with estimation of Pm

Understanding uncertainty of compensation through mitigation using APF (direct impacts only)

For example: assume 500 acre SWB, Pm = 0.1, Standard Error / Pm = 0.5



For average likelihood (50%) , Acres ~ 50. This means that with the uncertainty associated with sampling, there is a 50% or greater likelihood that 50 new acres will provide full compensation for lost larval resources.

This assumes:

1. Mitigation acres are similar to those in SWB
2. Restoration is successful

Understanding uncertainty of compensation through mitigation using APF (direct impacts only)

Uncertainty in estimating compensation value of proposed mitigation is primarily related to error in estimation of Pm:

1)What is correct estimate of error?

a) Sampling error associated with estimation of Pm – *as shown in report*
   i. Source water concentrations of larvae – calculated error rates are very high and **probably not realistic** for use with respect to Pm
   ii. Entrainment concentrations of larvae – error rates are low and **probably not realistic** for use with respect to Pm

b) Error assuming each species' Pm is an independent replicate
   i. The most appropriate calculation of error, given the standard logic behind the use of APF

Now – consider the ratio of SE/Pm – which expresses uncertainty in terms of units of impact

Use of error in calculations

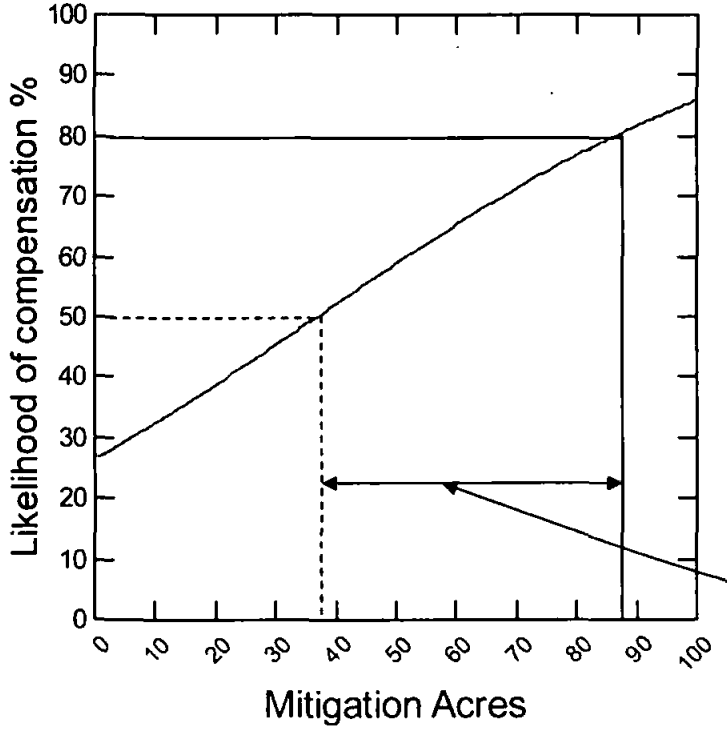
- Use of error to calculate cumulative confidence curves relies on decision as to which estimate of error is appropriate.
- I used a normal cumulative function to generate confidence curves.
  - This relies on mean value and estimate of the standard deviation of the population of means.
  - I concluded that sample standard deviation was inappropriate for use using this function and instead used the sample standard error as an estimate of the standard deviation of the population of means. Hence the calculation was:
    - Prob = ZCF((acres – mean acres)/calculated SE)
    - Where ZCF is the normal cumulative function
  - The use of SE led to more conservative (lower) estimate of (eg) 80% confidence limit than would have been the case if standard deviation was used.
  - This was evaluated using resampling approaches where possible (which make no assumptions about normality).

Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

Species	Pm	Calcuated SE	Ratio SE/ Pm	Source water body	Units
Estuarine					
Blennies	0.08635	0.1347	1.56	302	Acres
Gobies	0.21599	0.3084	1.43	302	Acres
Garibaldi	0.06484	0.1397	2.15	302	Acres
Open Water					
White Croaker	0.00138	0.0028	2.04	45	Km along shore
Northern Anchovy	0.00165	0.0026	1.56	21	Km along shore
California Halibut	0.00151	0.0024	1.58	37	Km along shore
Queenfish	0.00365	0.0049	1.33	27	Km along shore
Spotfin Croaker	0.00634	0.0153	2.41	19	Km along shore

These are huge

Uncertainty of compensation through mitigation using APF **Estuarine** Species (direct impacts only) **Case 1:** using error rate calculated in report (SE dominated by source water concentration of larvae)

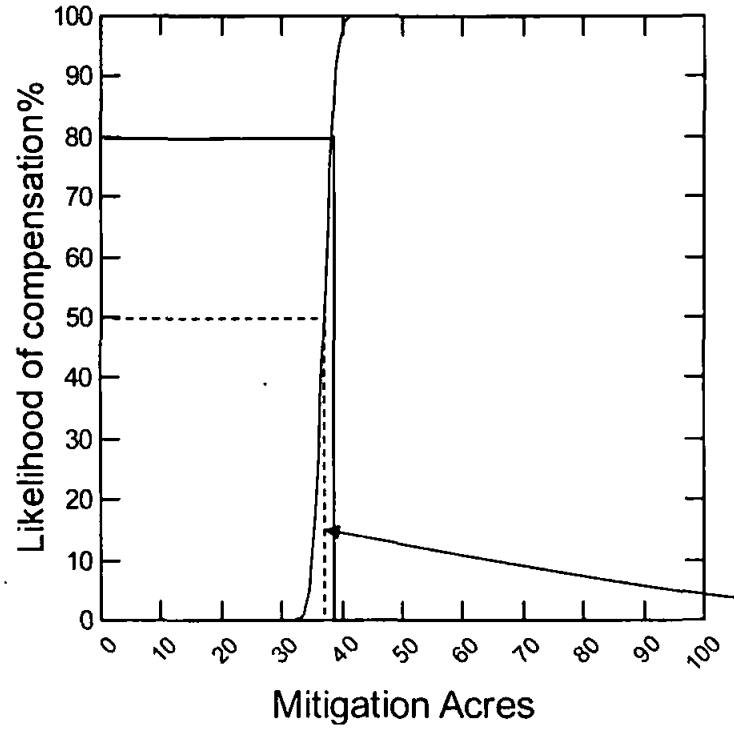


For average likelihood (50%)
Acres ~ 37

For 80% confidence level
Acres ~ 87

Big difference due to
Large SE/Pm ratio

Uncertainty of compensation through mitigation using APF **Estuarine** Species (direct impacts only) **Case 2:** using error rate calculated from entrainment estimates only (SE very low)



For average likelihood (50%)
Acres ~ 37

For 80% confidence level
Acres ~39

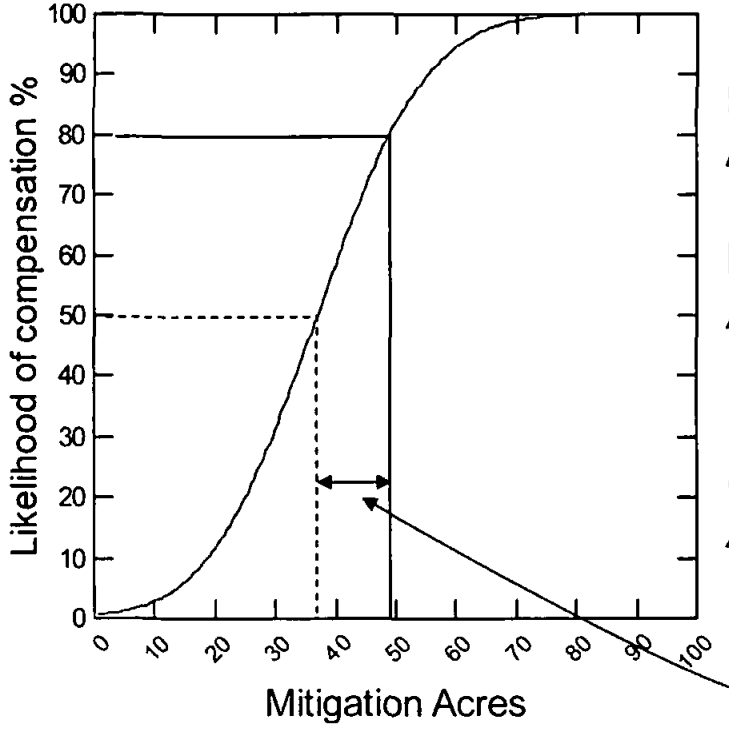
Small difference due to
Small SE/Pm ratio

Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

Species	Pm	Calcuated SE	Ratio SE/ Pm	Source water body	Units	APF	Source water body	Units	APF
Estuarine									
Blennies	0.08635	0.1347	1.56	302	Acres	26.0777			
Gobies	0.21599	0.3084	1.43	302	Acres	65.2290			
Garibaldi	0.06484	0.1397	2.15	302	Acres	~~19.5817~~			
Average	**0.12239**	0.1942				**36.9628**			
SE						**14.2570**			
Ratio SE/Pm						**0.3857**			
Open Water									
White Croaker	0.00138	0.0028	2.04	45	Km along shore*	0.0621	33365	Acres	46.0440
Northern Anchovy	0.00165	0.0026	1.56	21	Km along shore*	0.0347	15570	Acres	25.6912
California Halibut	0.00151	0.0024	1.58	37	Km along shore*	0.0560	27477	Acres	41.4907
Queenfish	0.00365	0.0049	1.33	27	Km along shore*	0.1000	20309	Acres	74.1289
Spotfin Croaker	0.00634	0.0153	2.41	19	Km along shore*	0.1175	13739	Acres	87.1029
Average						**0.0740**			**54.8916**
SE						**0.0151**			**11.2209**
Ratio SE/Pm						**0.2044**			**0.2044**

*** to a depth of 75 meters - average about 3 Km offshore**

Uncertainty of compensation through mitigation using APF
Estuarine Species (direct impacts only)
Case 3: using error rate calculated from species Pm estimates (*probably most accurate*)



For average likelihood (50%)
Acres ~ 37

For 80% confidence level
Acres ~49,

Using resampling
80% confidence level
Acres ~ 50

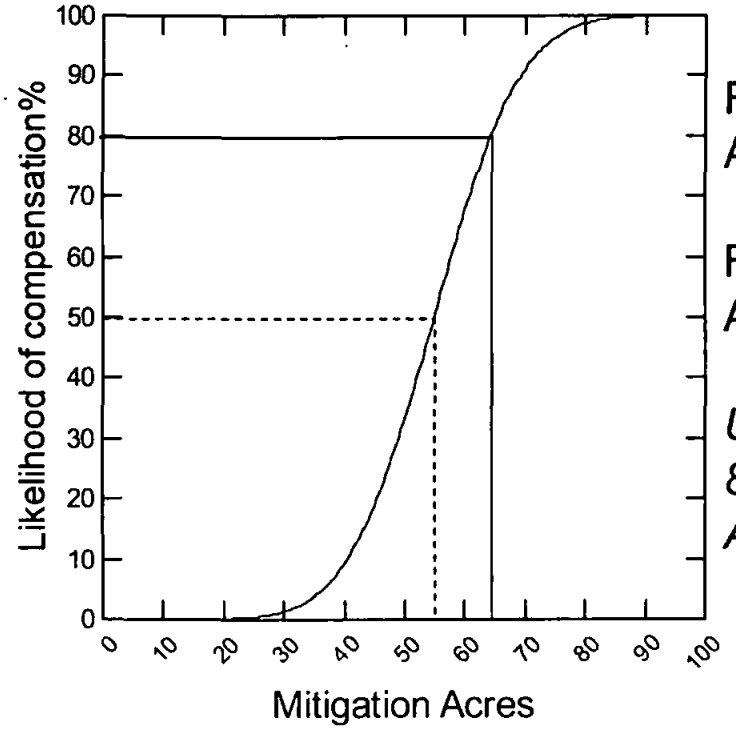
Relatively small difference due to appropriate SE/Pm ratio

Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

Species	Pm	Calcuated SE	Ratio SE/ Pm	Source water body	Units	APF	Source water body	Units	APF
Estuarine									
Blennies	0.08635	0.1347	1.56	302	Acres	26.0777			
Gobies	0.21599	0.3084	1.43	302	Acres	65.2290			
Garibaldi	0.06484	0.1397	2.15	302	Acres	19.5817			
Average	**0.12239**	0.1942				**36.9628**			
SE						**14.2570**			
Ratio SE/Pm						**0.3857**			
Open Water									
White Croaker	0.00138	0.0028	2.04	45	Km along shore*	0.0621	33365	Acres	46.0440
Northern Anchovy	0.00165	0.0026	1.56	21	Km along shore*	0.0347	15570	Acres	25.6912
California Halibut	0.00151	0.0024	1.58	37	Km along shore*	0.0560	27477	Acres	41.4907
Queenfish	0.00365	0.0049	1.33	27	Km along shore*	0.1000	20309	Acres	74.1289
Spotfin Croaker	0.00634	0.0153	2.41	19	Km along shore*	0.1175	13739	Acres	~~87.1029~~
Average						**0.0740**			**54.8916**
SE						**0.0151**			**11.2209**
Ratio SE/Pm						**0.2044**			**0.2044**

*** to a depth of 75 meters - average about 3 Km offshore**

Uncertainty of compensation through mitigation using APF **Open Coast** Species (direct impacts only) Using error rate calculated from species Pm estimates (*probably most accurate*)



For average likelihood (50%)
Acres ~ 55

For 80% confidence level
Acres ~ 64

Using resampling
80% confidence level
Acres ~ 63

APF summary

1) APF for estuarine species
   1) Mean APF = 37 acres
   2) 80% confidence limit = 49 acres
   3) Habitat mix for mitigation should include mudflat / tidal channel and open water habitat
2) APF for open coast species
   1) Mean APF = 55 acres
   2) 80% confidence limit = 64 acres
   3) Habitat is primarily open water, sandy bottom
   4) Relatively small area
   5) No mitigation options discussed
      a) Options that could lead to direct compensation are difficult

Proposed Wetland Mitigation

1) Logic of APF as applied to wetland mitigation is appropriate for estuarine species losses
2) In my opinion the most appropriate mitigation discussed is offsite wetland creation at San Dieguito
   a) The mix of habitats should mirror those used in calculating APF at Agua Hediondo – currently they do not (use of salt marsh at San Dieguito)
   b) The ongoing restoration at San Dieguito, along with inlet maintenance and required monitoring make this the area most likely to be successfully used for compensatory mitigation
   c) Mitigation at Agua Hediondo as described, is unlikely to provide direct compensation for lost larval resources

Comments on discussion of "conservative assumptions" for APF

1) "Assumes 100% mortality of all marine organisms entering the intake"
   a) This is true but it is the same assumption that is made in all recent entrainment determinations. Moreover there is no study of post-entrainment larval survival that has been conducted in field conditions
2) "Assumes 100 % survival of all fish larvae in their natural environment"
   a) No such assumption is made. The only assumption concerning survival is that there is no compensatory mortality that affects Pm calculations.

Comments on discussion of "conservative assumptions" for APF

3) "Assumes species are evenly distributed throughout the entire depth and volume of the water body"
   a) No such assumption is made. The major assumption is that creation of a similar mix of habitats to that found in the source water body will lead to compensation for all species lost due to entrainment.
4) "Assumes the entire habitat from which the entrained fish larvae may have originated is destroyed"
   a) No such assumption is made concerning the source water body. APF calculations are based on the idea of estimating the area that would need to be added in order to lead to the compensatory production of larvae lost to entrainment. Other features of the source water body are assumed not to have been damaged.

I. INTRODUCTION

My name is David Mayer of Tenera Environmental, Inc. Poseidon Resources Corporation asked me to prepare this statement regarding the potential entrainment and impingement ("E&I") effects of the proposed Carlsbad Desalination Plant, scheduled to begin operations in late 2011/early 2012. Here follows that statement. I look forward to addressing any questions you may have at the February 11 meeting.

II. QUALIFICATIONS

- Ph.D. in Fisheries, Ph.D. in Quantitative Sciences from the University of Washington.
- Over 30 years experience in environmental consulting specializing in studies of marine and freshwater systems.
- Extensive experience in the areas of aquatic temperature and flow regimes, and their effects on ecological systems, beginning with doctoral research analyzing and modeling the relationships of water temperatures and hydrodynamics on aquatic communities.
- Provided expertise and experience in research and problem solving freshwater issues associated with water intake location, screening technology, and discharge effects.
- Directed research scientists and engineers who provide contract services of environmental assessments and computer analysis in the disciplines of air quality, water quality, ecology, hazardous materials, and environmental risk assessment.

III. ROLE ON THIS PROJECT

A. Project Origin

In late 2003, Poseidon Resources ("Poseidon") retained Tenera Environmental ("Tenera") to determine the potential effects resulting from its proposed use of water from Agua Hedionda Lagoon. Tenera was asked to conduct a study to characterize the type and concentration of organisms within the source water for the cooling water intake structure and the incremental entrainment and impingement ("E&I") effects of the proposed desalination plant operations on these organisms when Poseidon is operating in conjunction with the Encina Power Station ("EPS"). This effort lead to the report entitled: *Carlsbad Desalination Facility Intake Effects Assessment*, prepared by Tenera Environmental, dated March, 2005, included as APPENDIX E to the Environmental Impact Report for the Carlsbad Desalination Project ("EIR") submitted to the Regional Board with Poseidon's NPDES permit application.

In response to comments received on the draft EIR, Poseidon expanded Tenera's scope of work to include an analysis of the impacts of the Project if it were to operate at times when the EPS was not providing it sufficient feedstock water. This effort used the same E&I data that Tenera collected for the EPS Clean Water Act Section 316(b) study. Tenera's 316(b) study proposal ("Study Protocol") was submitted to the Regional Board for review and approval. On behalf of the Regional Board, Tetra Tech conducted an independent peer-review of the Study Protocol. The final, Regional Board-approved

Study Protocol was included as Attachment 3 to Poseidon's March 6, 2008 Flow, Entrainment and Impingement Minimization Plan ("Minimization Plan"), previously submitted to the Regional Board.

The data were collected over a twelve-month period from June 2004 to May 2005. Tenera reported the study results in various forms to support Poseidon's efforts to secure project approvals from the City of Carlsbad, Regional Board, State Lands Commission and Coastal Commission. In addition, Tenera responded to numerous comments and questions from the state agencies. Specifically, with regard to the Regional Board staff's comments, Tenera testified at the April 9, 2008 meeting on the Minimization Plan and prepared detailed written responses to staff's February 19, 2008 letter and April 17, 2008 email regarding the E&I study. See Poseidon's March 6, 2008 revised Minimization Plan, Poseidon's March 7, 2008 written responses to the Regional Board staff's February 19, 2008 letter, and Poseidon's April 30, 2008 written responses to staff's email dated April 17, 2008.

Tenera's E&I study for the EPS was submitted to the Regional Board January 2008 (see "CLEANWATER ACT SECTION 316(b) IMPINGEMENT MORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment January 2008 Prepared by: Tenera Environmental). This study, along with the work Tenera had provided in support of Poseidon's permitting applications, was reviewed by Dr. Pete Raimondi, an independent scientist with expertise in evaluating entrainment studies. The Coastal Commission contracted with Dr. Raimondi to advise the Commission on the development of Poseidon's Marine Life Mitigation Plan. Dr. Raimondi provided the initial results of his review and recommendations to the Coastal Commission in April 2008.

Dr. Raimondi determined that Tenera's entrainment sampling and data collection methods were consistent with those used in other recent studies conducted in California pursuant to the protocols and guidelines used by the U.S. EPA, Regional Water Quality Control Boards, California Energy Commission and Coastal Commission. Dr. Raimondi also found that the study provided adequate data to determine the types and numbers of organisms that would be subject to entrainment and to determine the mitigation requirements for the Project. Dr. Raimondi's conclusions were subsequently peer-reviewed by the Coastal Commission's Marine Science Advisory Panel (SAP).

B. E&I Study Methodology

The entrainment study was designed to specifically address the following issues:

1. What species of fish larvae are entrained through the EPS cooling water intake structure, what is their abundance, and what proportion of these organisms would be susceptible to entrainment by the desalination plant feedwater withdrawal?

2. What numbers of *Cancer* spp. crabs, and spiny lobster are entrained through the EPS cooling water intake structure and what proportion of these organisms would be susceptible to entrainment by the desalination plant feedwater withdrawal?

3. How might any additional losses of organisms due to desalination plant feedwater entrainment affect the source populations of the entrained species in Aqua Hedionda Lagoon and the Southern California Bight?

4. Are these losses ecologically or economically significant?

The study required an assessment of both the source water for the EPS (lagoon and ocean) and the intake at the EPS. The source water was analyzed to establish population characteristics (relative abundance) for species potentially impacted by the desalination plant.

The entrainment assessment included in the *Flow, Entrainment and Impingement Minimization Plan* (Plan) for the Carlsbad Desalination Project relies on the monthly samples taken in the lagoon near the entrance to the EPS intake structure (station E1); and therefore it is representative of stand-alone operation.

The entrainment assessment in the Plan is based principally on a 12-month study from June 2004 to June 2005. Entrainment and source water sampling was conducted monthly from June 2004 through May 2005, except that two surveys were done in June 2004 separated by a two-week interval. The thirteen surveys provided a complete year of seasonal data for 2004–2005. The details of both the study methods and findings are presented in their entirety in the Tenera report titled, "CLEANWATER ACT SECTION 316(b) IMPINGEMENT MORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment January 2008", submitted to the Regional Board in January 2008.

Entrainment samples were collected from a single station located in front of the EPS intakes (E1). They were collected using a bongo frame with paired 0.71 m (2.33 ft) diameter openings each equipped with 335 μm (0.013 in) mesh plankton nets and codends. The start of each tow began approximately 30 m (98 ft) in front of the intake structure and proceeded in a northwesterly direction against the prevailing intake current, ending approximately 150 m (492 ft) from the intake structure. See Figure 1.

Source water Plankton samples were also collected monthly at four source water stations in Agua Hedionda Lagoon and five nearshore stations adjacent to the EPS. The source water stations ranged in depth from approximately –1.8 m (–5.9 ft) MLLW and to-34.1 m (–111.9 ft) MLLW. The stations were stratified to include stations in the Inner, Middle and Outer Lagoon, and at varying distances upcoast, downcoast, and offshore from the mouth of the lagoon.

A total of 20,601 larval fishes representing 41 taxa were collected from the EPS entrainment station E1 during 13 monthly surveys in the 2004 to 2005 sampling period. Gobies (CIQ goby complex) and blennies comprised over 90% of all specimens collected.

The results from a separate in-plant entrainment mortality study referred to in Staff's review were not used in the entrainment assessment for stand-alone operation of the desalination facility. This information was used to calculate the incremental mortality associated with the desalination facility when operating jointly with the power plant.

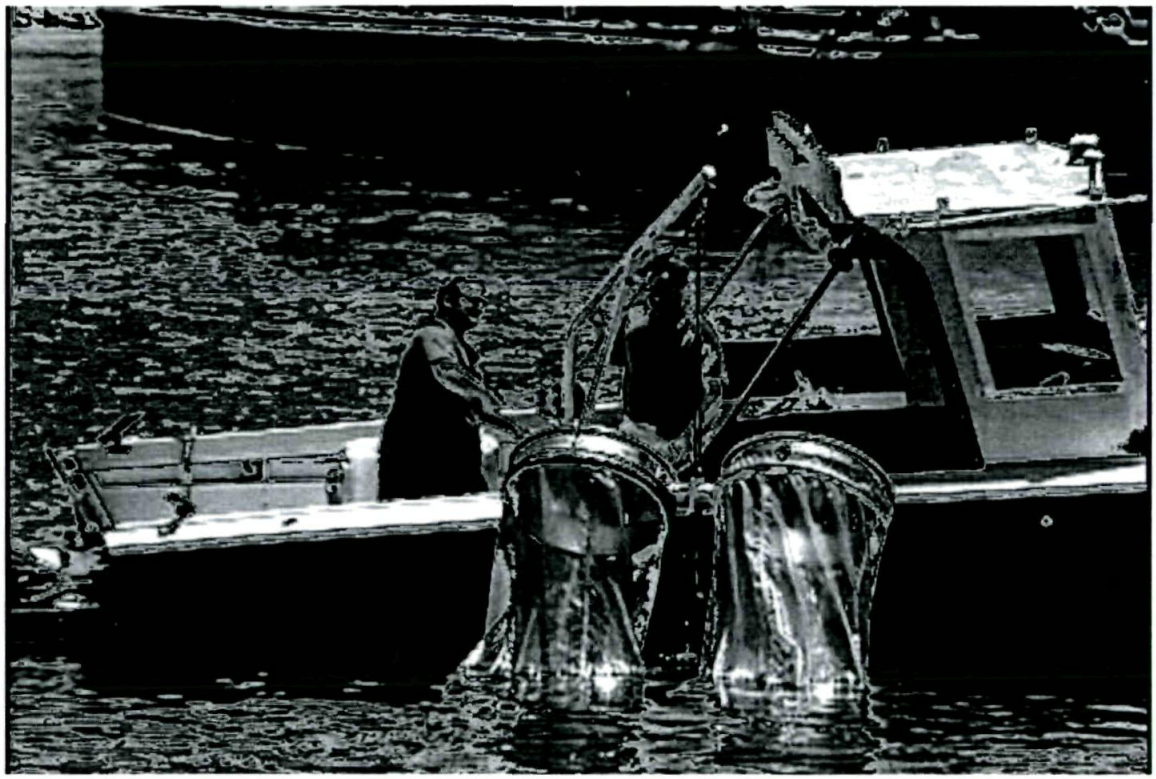


Figure 1- Entrainment Sampling Process

Laboratory processing for both the feedwater and source water consisted of sorting (removing), identifying, and enumerating all larval fishes, pre-adult larval stages of *Cancer* spp. crabs, and California spiny lobster larvae from the samples. Identification of larval fishes was done to the lowest taxonomic level practicable.

IV. SUMMARY STATEMENT

In my role as an expert in the field of entrainment and impingement analysis, I address the following general points in this statement:

- Tenera Environmental used proven and universally accepted sampling practices when it collected entrainment and impingement samples for the Encina Power Station (EPS) in 2004-2005. These practices resulted in the collection of valid and scientifically sound data that are relevant and useful to the assessment of potential E&I impact.

- Tenera Environmental applied proven and universally accepted modeling techniques and statistical analysis to the sampling data to estimate the potential for entrainment and impingement-related impacts from the CDP's future operations.

- To the best of my knowledge, all of the information that was generated by Tenera Consultants pursuant to the EPS 316(b) E&I Study and was available for Dr. Raimondi to rely upon in assessing the CDP's entrainment impacts, either previously has been submitted to the Regional Board or will be submitted to the Board in connection with the February 11 hearing. This documentation includes:

    1. Attachments to Revised Flow, Entrainment, Impingement and Minimization Plan (March 2008)

        a. Impingement Results (Attachment 2)

        b. Proposal For Information Collection, Clean Water Act Section 316(B), Encina Power Station, April 1, 2006 (Attachment 3)

        c. Updated Impingement and Entrainment Assessment, Tenera Environmental, May 2007 (Attachment 4)

        d. A Summary of Fish and Target Shellfish Larvae Collected For Entrainment and Source Water Studies In the Vicinity of Agua Hedionda Lagoon From June 2005 through May 2006

    2. CLEANWATER ACT SECTION 316(b) IMPINGEMENTMORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY, "Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment", January 2008

    3. Email and memorialized telephonic conversations between Tenera and Dr. Raimondi. See Attachment B.

V. DISCUSSION

A. The data obtained pursuant to EPS's Board-approved E&I study were collected in accordance with commonly accepted practices.

As a leading expert in the field of entrainment and impingement analysis, I can attest to the fact that the E&I Study that Tenera conducted from June 2004 to May 2005 was performed in accordance with commonly accepted practices and in conformity with the Study Plan that the Regional Board and the Board's independent, third-party technical reviewer previously had approved.

My proposed study also benefited from the comments and review offered by resource agency experts. These experts were part of a technical working group that the Board convened to provide peer review and stakeholder interaction.

B. CDP used EPS's E&I data to estimate CDP's projected stand-alone impacts.

Tenera's scope of work was expanded to analyze the potential E&I impacts should CDP's feedstock requirements exceed the cooling water requirements of EPS. This was in response to comments received on the draft EIR that suggested CDP operations might adversely impact marine organisms through entrainment and impingement should the CDP operate independent of the EPS. Tenera Environmental analyzed the E&I impacts of "stand-alone" CDP operations.

C. Tenera made simple modeling adjustments to identify CDP-related impacts.

Since CDP planned to use EPS's existing intake structure, Tenera used the data it collected for the EPS 316(b) study to estimate CDP's entrainment and impingement-related impacts. In order to isolate and account for impacts related to CDP's stand-alone operations, Tenera made several simple adjustments to the data.

1. Impingement data translation

First, Tenera translated EPS's impingement data into CDP-projected impacts. Whereas EPS's average intake flow during the 2004/2005 sampling period was 632.6 MGD,[1] CDP's maximum intake flow will be only 304 MGD. Because EPS's intake flow volumes during this perod exceed those necessary to meet the CDP's future feedstock requirements, the EPS's impingement impacts are proportionally greater than CDP's potential impacts.

To isolate the impingement impacts associated with CDP's stand-alone intake operations, Tenera conducted a regression analysis that factored in EPS's impinged biomass (kg) observed during weekly 24-hour surveys against the flow rates (MGD) measured during the 50 impingement surveys conducted from June 2004 to June 2005. The resulting regression equation was solved in order to project a daily impingement rate at desalination plant flow rates of 304 MGD.

As shown in Figure 2, the sampling period flow rate consistently exceeded the stand-alone desalination plant flow of 304 MGD. Regression of these data resulted in an estimated, average daily impingement effect of 1.56 kg from the desalination plant stand-alone operations at 304 MGD. We found a statistically significant relationship between the impingement effects and flows measured under normal power plant operations that occurred during the June 2004 to June 2005 impingement survey.

[1] March 6, 2008 Minimization Plan, page 5-3

It is important to note that 6 of the 13 samples collected for plant intake flows at or below 550 MGD had impingement effect approximately equal to or less than the initially estimated daily impingement effect 0.96 kg/day. Another trend that can be noted in Figure 1 is that the opposite is true for flows above 550 MGD -- the majority of the impingement results are above the average of the curve.

This observation is consistent with nationwide findings on the relationship of intake volume, velocity, and impingement that indicate an impingement threshold at or above a velocity of approximately 2 fps. Below this velocity, impingement effects decline rapidly. The impingement effects continue to dramatically decline as the intake approach velocity nears 0.5 fps and below. In essence, the lower the velocity, the greater the likelihood that fish will be able to navigate away from the intake structure, and avoid impingement. The desalination plant stand-alone operations at 304 MGD will mirror these conditions -- intake approach velocities at the bar racks will be approximately 0.5 fps. Consequently, we expect to observe a velocity-driven impingement reduction effect during stand-alone operations that will result in impingement rates that are below the statistical projection of 1.56 kg/d, and possibly below 1.0 kg/d.

The total weight of impinged species collected over the 13-month sample period was 3,651 kilograms. This level of impingement represents a *de minimis* impingement effect. During the collection period, intake volumes were more than twice as high as those needed to meet Poseidon's feedstock needs, and intake velocities also were higher than those which will occur during stand-alone operations. These factors render the straight-line extrapolation value of 1.56 kg/d conservative, probably significantly so.

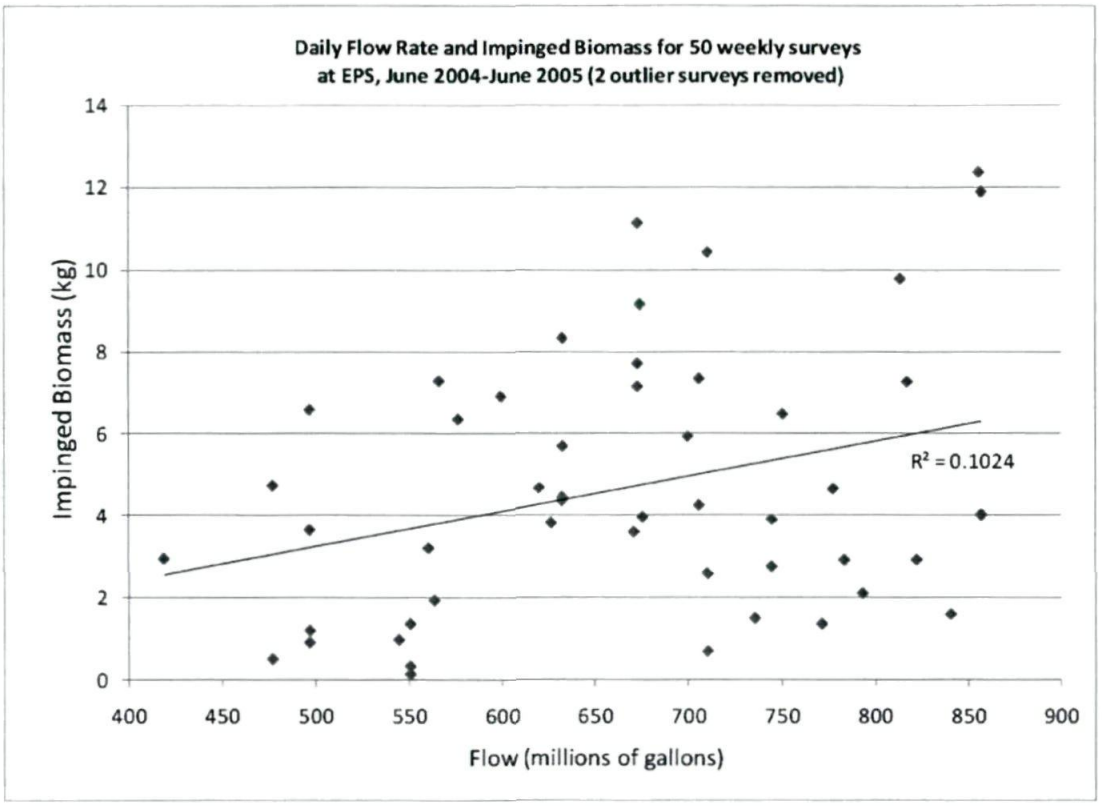


Figure 2.

2. Entrainment data translations

The process of translating the entrainment data also was relatively simple because entrainment impacts are directly proportional to flow through the intake. Tenera simply divided CDP's projected flow rate (i.e., 304 MGD) by EPS's average flow rate over the sampling period to calculate a proportional flow rate. For instance, if EPS's average flow rate over a given time period was 608 MGD, then CDP's proportional flow rate for that period would have been 50% (304/608).

Tenera would then multiply CDP's proportional flow rate (50% in this example) by EPS's entrainment impact over that time period. So, for example, if Tenera had estimated that EPS had entrained 1000 organisms during the time period, then Tenera would have applied the 50% value to determine that CDP's operations would have entrained 500 organisms.

D. CDP's impingement-related impacts will be *de minimis*

The reduction in EPS intake flows and the elimination of heat treatment utilized by the power stations for fouling control will lower impingement at the desalination plant intake to *de minimis* levels. The projected desalination plant impingement at 304 MGD is expected to be even lower than projected by the

results of my linear regression analysis. I base this conclusion on the fact that CDP will be able to reduce the intake flow velocity to a rate of about 0.5 fps.

Lower intake velocities allow more juvenile and adult fish to avoid intake. As a leading expert in the field of impingement analysis, I agree with the EPA's determination in the context of establishing the "best technology available" under Section 316(b) of the federal Clean Water Act for new facilities utilizing cooling water intake structures (Phase I Rule), that a maximum intake velocity of 0.5 fps or less minimizes adverse environmental impacts associated with impingement mortality to acceptable levels. [2]

In developing the Phase I Rule, the EPA found that an approach velocity of 0.5 fps to protect fish species from impingement previously was used as guidance in at least three federal agency reports,[3] which were based in part on a study of fish swimming speeds and endurance performed by Sonnichsen et al. (1973).[4] To include an additional layer of conservatism for the Phase I Rule, the EPA prepared an additional analysis that concluded "thresholds should be based on the fishes' swimming speeds (which are related to the length of the fish) and endurance (which varies seasonally and is related to water quality)."[5] This analysis demonstrated that "the species and life stages evaluated could endure a velocity of 1.0 ft/s."[6] However, to "develop a threshold that could be applied nationally and is effective at preventing impingement of most species of fish at their different life stages, EPA applied a safety factor of two to the 1.0 ft/s threshold to derive a threshold of 0.5 ft/s. This safety factor, in part, is meant to ensure protection when screens become partly occluded by debris during operation and velocity increases through portions of the screen that remain

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[2] *See* 66 Fed. Reg. 65274; *see also* 40 C.F.R. 125.84(b)(2), 125.84(c)(1).

[3] 66 Fed. Reg. 65274 (citing Boreman, J. 1977. Impacts of power plant intake velocities on fish. Power Plant Team, U.S. Fish and Wildlife Service; 33 Christianson, A. G., F. H. Rainwater, M.A. Shirazi, and B.A. Tichenor. 1973. Reviewing environmental impact statements: power plant cooling systems, engineering aspects, U.S. Environmental Protection Agency (EPA), Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon, Technical Series Report EPA–660/2–73–016; King, W. Instructional Memorandum RB–44: Review of NPDES (National Pollutant Discharge Elimination System) permit applications processed by the EPA (Environmental Protection Agency) or by the State with EPA oversight.'' In: U.S. Fish and Wildlife Service Navigable Waters Handbook.)

[4] Sonnichsen, J.C., Bentley, G.F. Bailey, and R.E. Nakatani. 1973. A review of thermal power plant intake structure designs and related environmental considerations. Hanford Engineering Development Laboratory, Richland, Washington, HEDL–TME 73– 24, UC–12.

[5] 66 Fed. Reg. 65274.

[6] *Id.*

open."[7] Further, "EPA compiled the data from three studies[8] on fish swim speeds ...[which] suggest that a 0.5 ft/s velocity would protect 96 percent of the tested fish."

Based on evidence provided by the EPA for the Phase I Rule and my personal experience, it is my expert opinion that if the Project reduces its intake flows to 0.5 fps or less, then impacts related to impingement will be *de minimus*.

E. Scientists Customarily Apply a 50% Confidence Level When Calculating APF and Apply No Mitigation Ratio

When he reviewed Tenera's ETM Calculations for the California Coastal Commission, Dr. Raimondi applied an 80% confidence level APF as the basis for mitigation. This approach represents a significant departure from the way that entrainment studies have been conducted in the past and is much more conservative than the customary/traditional method.

As an expert in the field of entrainment analysis, I can attest to the fact that entrainment studies typically apply a 50% confidence level APF and then apply no mitigation ratio.

F. Questions/Concerns Raised by the Regional Board

In the years since Poseidon applied for CDP's NPDES permit, the Regional Board has raised some questions regarding CDP's projected environmental impacts. To the extent that these questions relate to either the adequacy of the data that Tenera obtained through sampling or the validity of the modeling techniques that Tenera applied—two areas that fall squarely within my area of expertise—I would like to take this opportunity to reiterate and elaborate upon responses previously provided.

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[7] *Id.*

[8] *Id.* (*citing* University of Washington study [Smith, L.S., L.T. Carpenter. Salmonid Fry Swimming Stamina Data for Diversion Screen Criteria. Prepared by Fisheries Research Institute, University of Washington, Seattle, WA for Washington State Department of Fisheries and Washington State Department of Wildlife, 1987], Turnpenny [Turnpenny, A.W. H. The Behavioral Basis of Fish Exclusion from Coastal Power Station Cooling Water Intakes. Central Electricity Generating Board Research Report, RD/L/3301/R88, 1988], and EPRI [EPRI. Technical Evaluation of the Utility of Intake Approach Velocity as an Indicator of Potential Adverse Environmental Impact Under Clean Water Act Section 316(b). Technical Report. 1000731, 2001])

1. *Staff has questioned whether the sampling data obtained pursuant to the Board-approved E&I sampling plan is flawed by the fact that the year when the samples were taken—i.e, June 2004 to May 2005—was a particularly rainy year. From this fact, staff deduced that (a) large amounts of fresh rainwater runoff emptied into the Agua Hedionda Lagoon (AHL), which (b) decreased the salinity levels in the lagoon thereby (c) driving marine life from the lagoon and changing the lagoon species mix. As a consequence, staff has implied (d) that the samples that were taken from the AHL during that period underrepresented the number and density of entrainable and impingeable marine organisms, thereby (e) resulting in mitigation requirements that underestimate CDP's unavoidable impacts.*

As Dr. Scott Jenkins explained at the Regional Board's April 9, 2008 meeting on Poseidon's Minimization Plan, the heaviest rains in 2005 only slightly depressed salinity levels from 33.52 ppt under dry conditions to at most 30.75 ppt during peak storm runoff (lasting for a period of 2.6 days).

On the basis of my professional experience in this area, I can say with confidence that such a slight depression in the lagoon's salinity levels during peak storm runoff would not materially affect the marine species mix over the period of the data collection effort. Therefore, the E&I study did not under-represent the number or density of marine organisms in the lagoon, nor did it underestimate the extent of CDP's potential impacts.

2. *Staff have questioned whether the entrainment model is limited because it focuses too narrowly on the few most commonly entrained (most abundant) species and does not consider how severe the impacts may be when populations are small. (02/19/08 Letter, #14)*

   In response, I would note, first of all, that the entrainment model can be applied to any species that is collected in entrainment samples—whether it is abundant or rarely collected. However, since our level of confidence and ability to reach any meaningful conclusion about entrainment effects on the species' population diminishes with the number of specimens in a sample, our decision to use abundant species is based on statistical principles.

   The abundances (densities) of all of the larval fish species collected in our entrainment surveys are included in our entrainment study reports. Nevertheless, we only analyze entrainment effects on species that yield meaningful results (i.e., the most commonly entrained species). As an expert in this field, I have used this approach in entrainment study analyses with ETM modeling, as well as in fecundity hindcast (FH) and adult equivalent loss model analyses.

3. *Staff has questioned whether the ETM (Empirical Transport Model) underestimates the Area of Production Foregone (APF) because the estimate of the number of lagoon acres used by the three most commonly entrained species excludes salt marsh and brackish/freshwater acreage. (02/18/08, 15(b))*

   The areas of Agua Hedionda Lagoon that have the potential to be impacted by the CDP operations are those habitats occupied by the three most commonly entrained lagoon fish larvae (98% of the fish larvae that would be entrained by the CDP stand-alone operations are globies, blennies and hypsopops). These habitats include 49 acres of mudflat/tidal channel and 253 acres of open water.

   It is not appropriate to include other lagoon habitats in the APF calculation, such as brackish/freshwater, riparian, salt marsh or upland habitats that are not occupied by the impacted species. Note that Dr. Raimondi and the Coastal Commission independently endorsed the decision to limit the source water body value to the 302 areas consisting of the most commonly entrained species.

4. *Staff has requested clarification regarding how the estimated lagoon acreage for commonly entrained species was adjusted to include only impacts associated with operations of CDP, rather than impacts from operation of the Encina Power Station. (02/19/08, 16(d))*

   As I explain above, entrainment impacts are directly proportional to the quantity of water flowing through the intake. Therefore, the EPS entrainment data can be adjusted to account for CDP's stand-alone operation by multiplying the EPS's entrainment-related impacts (for the given time period) by the ratio of the CDP flow (304 MGD) divided by the EPS flow measured over that same period.

5. *Staff has argued that that Tenera's APF calculations are flawed because "the data used to derive [these] calculation[s] [were] preliminary, and lack[ed] statistical power." (04.04.08 Technical Report)*

   Tenera completed EPS's 316(b) E&I Study in January 2008 and that study is part of Poseidon's administrative record. Consequently, the Regional Board has before it the complete and final (i.e., non-preliminary) data set upon which the revised APF figures are based. As an expert in the field of entrainment and impingement, and as one having conducted countless statistical computations, I can say with confidence and authority that the final figures do not lack statistical power. To the contrary, these data are sound and have been validly used to calculate CDP's projected APF.

   Furthermore, this study, along with the work Tenera had provided in support of Poseidon's permitting applications, was reviewed by Dr. Pete

Raimondi, an independent scientist with expertise in evaluating entrainment studies. The Coastal Commission contracted with Dr. Raimondi to advise the Commission on the development of Poseidon's Marine Life Mitigation Plan. Dr. Raimondi provided the initial results of his review and recommendations to the Coastal Commission in April 2008 and that study is part of Poseidon's administrative record. Dr. Raimondi was able to determine that Tenera's APF calculations were generally consistent with those used in other recent entrainment studies. Dr. Raimondi's conclusions subsequently were peer-reviewed by the Coastal Commission's Marine Science Advisory Panel.

VI. ATTACHMENTS

A. Curriculum Vitae

B. Email and memorialized telephonic correspondence between Tenera and Dr. Raimondi (*see* Attachment B)

C. Annotated Power Point presentation given by Dr. Raimondi to Coastal Commission Staff, Poseidon Resources Corporation, and consultants in San Francisco on April 25, 2008; annotations provided by Dr. David Mayer